THEATER ENGINEER SUPPORT AND THE THEATER SUPPORT COMMAND

A MONOGRAPH
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This monograph describes the TSC organizations that were experimented with in the Prairie Warrior 95 and 96 Advanced Warfighting Experiments. Key observations made by the TRADOC Combined Arms Assessment Team (CAAT) regarding theater engineer support and the TSC during these exercises were identified. The CAAT's key observations were then analyzed to identify what organizational characteristics the theater organization must have to best meet the Army's future engineering needs.

The findings from this study do not fully support the research hypothesis. The findings indicate that the TSC may require a habitually associated, modular and tailorable engineer command and control (and/or planning) capability that is primarily focused on the engineer battlefield function of general engineering in the communications zone. The findings also indicate that theater commander may also require a habitually associated, modular and tailorable engineer command and control element that is focused on all five engineer battlefield functions throughout the theater.

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Accepted this 18th Day of April 1997

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ABSTRACT

THEATER ENGINEER SUPPORT AND THE THEATER SUPPORT COMMAND by Major Robert A. Sinkler, USA, 60 pages.

The effectiveness of the engineer organization described in the *Concept for Support Command and Control at Echelons above Corps* (Theater Support Command Concept) is analyzed in this monograph. The research hypothesis was: The engineer command and control organizational structure described in the Theater Support Command (TSC) Concept is the organization to most effectively meet the military engineering needs of the force projection Army of the twenty-first century.

This monograph describes the TSC organizations that were experimented with in the Prairie Warrior 95 and 96 Advanced Warfighting Experiments. Key observations made by the TRADOC Combined Arms Assessment Team (CAAT) regarding theater engineer support and the TSC during these exercises were identified. The CAAT's key observations were then analyzed to identify what organizational characteristics the theater organization must have to best meet the Army's future engineering needs.

The findings from this study do not fully support the research hypothesis. The findings indicate that the TSC may require a habitually associated, modular and tailorable engineer command and control (and/or planning)capability that is primarily focused on the engineer battlefield function of general engineering in the communications zone. The findings also indicate that theater commander may also require a habitually associated, modular and tailorable engineer command and control element that is focused on all five engineer battlefield functions throughout the theater.

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CHAPTER 1 - INTRODUCTION

Background

The U.S. Army will have to rapidly deploy from the continental United States and be ready to immediately execute (and support) military operations upon entry into a theater. The Army will also have to operate over a larger battlespace and at an increased tempo.[1] Force XXI Operations - full-dimensional operations of the early 21st century - will require different organizational structures and different tactics, techniques and procedures as a result of the temporal and spatial changes in 21st century warfare brought on by changing strategic and technological environments.[2]

Is modularity the next step in the evolution of the U.S. Army Corps of Engineers at echelons above division? Does it makes sense to put the theater engineer structure under a Theater Support Command to eliminate redundant headquarters, centralize control of limited logistics support units, and make theater support units more deployable and responsive? Can engineer organizations be under the command and/or control of combat service support units as they routinely are with combat units? Is placing the theater engineer command and control organization under

a theater support command the best way to tailor a rapidly deployable theater support organization to meet theater logistics requirements? This monograph will attempt to answer these questions.

The theater Engineer Command (ENCOM) structure was subordinate to a Theater Support Command (TSC) during the Prairie Warrior 96 exercise conducted at Ft. Leavenworth, Kansas. Placing the theater engineer structure under the TSC during this exercises has met a significant amount of resistance from the U.S. Army engineer community.[3] Likewise, deviations from the theater support command organization structure explained in the current *Concept for Support Command and Control at Echelons Above Corps* has met some resistance from the U.S. Army logistics community.[4] This monograph will objectively analyze the theater support command organization that participated in recent Prairie Warrior exercises to determine what theater logistics organization will most effectively meet the military engineering needs of the Force Projection Army of the twenty-first century.

Scope and Purpose

The purpose of this monograph is to analyze the effectiveness of the engineer organization described in the *Concept for Support Command and Control at Echelons above Corps* (hereafter referred to as the Theater Support Command Concept).[5] The focus of this monograph is on the objective

engineer organization for a mature theater and does not address how, or in what sequence that organization should be arrived at since each operational situation is different. This monograph does address ways in which the theater engineer organization can better support the force projection army through doctrinal and organizational change.

Importance

"Power Projection is a fundamental principle of our *National Military Strategy*. Therefore, force projection is fundamental to Army doctrine. The Army's dependence on force projection dictates that organizational designs be structured to support units with the capability of deploying the right amount of capability with the minimum force structure necessary to successfully accomplish the mission".[6] *Tailorability* and *modularity* are key concepts of a capabilities-based army.[7] The command and control structure that is most effective for a tailorable, modular, and multi-functional engineer organization is addressed in this monograph. This monograph has the potential of effecting the doctrine and organizational design of the engineer force of the twenty-first century. This monograph also captures and analyzes the findings regarding a key aspect of two major U.S. Army Advanced Warfighting Experiments.

Primary Research Question

The primary research question that this monograph addresses is: What theater logistics organization will most effectively meet the military engineering needs of the future Army? The research hypothesis is that the engineer command and control organizational structure described in the TSC concept is the organization to most effectively meet the military engineering needs of the force projection Army of the twenty-first century.[8]

Assumptions

There are three underlying assumptions key to this research. First, the Prairie Warrior 95 and 96 exercises were representative of Theater Support Command operations in a mature theater. Second, observations by the U.S. Army Training and Doctrine Command (TRADOC) Combined Arms Assessment Teams were objective and unbiased. And, third, there will never be enough engineer units in theater to eliminate the competition for engineer units to support combat, combat support (CS), and combat service support (CSS) missions.[9]

Research Design

Insights and observations regarding the TSC were captured by the TRADOC Combined Arms Assessment Teams during the Prairie Warrior 95 and 96 exercises and were analyzed to determine what organizational characteristics the theater

logistics organization must have to best meet the military engineering needs of the Army of the twenty-first century.

The research methodology consisted of two broad phases. First, a thorough review of current literature was conducted to identify appropriate design requirements for support command and control at echelons above corps. Second, findings, results, and observations from the Prairie Warrior 95 and 96 exercises were analyzed to determine what organizational characteristics the theater logistics organization must have to best meet the military engineering needs of the future Army. The results were then used to determine findings and conclusions that were relevant to the organizational design and doctrine of the theater engineer force of the twenty-first century.

Findings

Unexpectedly, the findings from this study do not conclusively support the research hypothesis. The findings did indicate that the theater support command would be more effective if it had an engineer command and control (and/or planning) capability subordinate to it focused on general engineering support to the Communications Zone (COMMZ). The results also indicated that placing the theater engineer command subordinate to the TSC may hinder the effective employment of the limited engineer units and resources throughout the theater. The findings from this study were similar to the findings from an independent study entitled

Engineer Command Relation to the Theater Support Command published in August 1996 by the Office of the Deputy Chief of Staff Simulations and Analysis, U.S. Army Training and Doctrine Command.[10]

CHAPTER 2 - BODY

Organizational Requirements for the Force Projection Army

Much has been written about twenty first century warfare, but only one key military publication addresses the organizational issues that face the Army of the twenty-first century. *TRADOC Pamphlet 525-5, Force XXI Operations* addresses twenty-first century organizational designs in the context of an operational concept for the strategic Army of the early 21st century. *TRADOC Pamphlet 525-5, Force XXI Operations* identifies four organizational requirements for the Army of the twenty-first century. First, the organizational design must allow units to be rapidly tailored to support Force XXI operations. Second, units must be organized "around information processing and dissemination."[11] Third, leader-to-led ratios must be flexible enough to be tailored for specific missions.[12] And, fourth, the Force XXI Army will be organized around the division as the major tactical formation.[13]

Concept of Modularity

TRADOC Pamphlet 525-68, Concept for Modularity supports *TRADOC Pamphlet 525-5, Force XXI Operations* and

addresses the specific organizational characteristics of the Army that will be needed to support the rapid force tailoring for the force projection Army. *TRADOC Pamphlet 525-68, Concept for Modularity* identifies five characteristics of the twenty-first century Army:

> (1) Modular designed elements will consist of modules and elements of specific capability.
>
> (2) Modular designed elements will permit [Tables of Organization and Equipment (TOE)] sub-elements to be detached from a parent unit and assigned to a contingency force for an indefinite period of time.
>
> (3) Modular designed elements may be achieved by splitting an organization into separate elements. For example, a "parent" module or element may remain in a secure location (permanently or until it, too, displaces forward) while a force projection module or element deploys independently of the parent.
>
> (4) Modular designed elements may be created as teams to provide augmentation to units requiring special capabilities for specific missions.
>
> (5) Modular designed elements will permit projection of specific modules and elements of capability that meet the minimum needs of a commander in contingency operations, with additional modules and elements provided as events require.[14]

Force XXI Design Principles

The former Army Chief of Staff General Gordon R. Sullivan distilled the future organizational requirements discussed in the two aforementioned TRADOC pamphlets into nine Force XXI design principles. General Sullivan

described the Force XXI design principles as capabilities to:

- Organize to optimize information-based operations.
- Dominate battlespace: speed, space and time.
- Control battlefield tempo with overwhelming lethality and superior survivability.
- Mount, execute and recover from operations simultaneously.
- Execute quick, decisive victory with minimum casualties.
- Remain rapidly deployable and operationally agile.
- Enhance tailorability through modularity across the force.
- Divert tasks that inhibit the division's primary mission: to fight and win battles and engagements.
- Maintain effectiveness in war and operations other than war as part of joint and multinational teams in all operational environments.[15]

The literature indicates that future U.S. Army organizations will need to be made up of modular, capabilities-based units designed around core wartime missions. Force XXI combat, combat support, and combat service support units at all echelons will need to be both tailorable and modular to ensure rapid deployability and operational agility. Modular units will have to be designed

around the minimum capability needed by a supported commander. Also, TOE sub-elements must be able to be detached from the parent unit and be able to be assigned to a supported unit for an indefinite period of time. The TSC design incorporates these and other emerging design requirements for force projection Army of the twenty-first century.

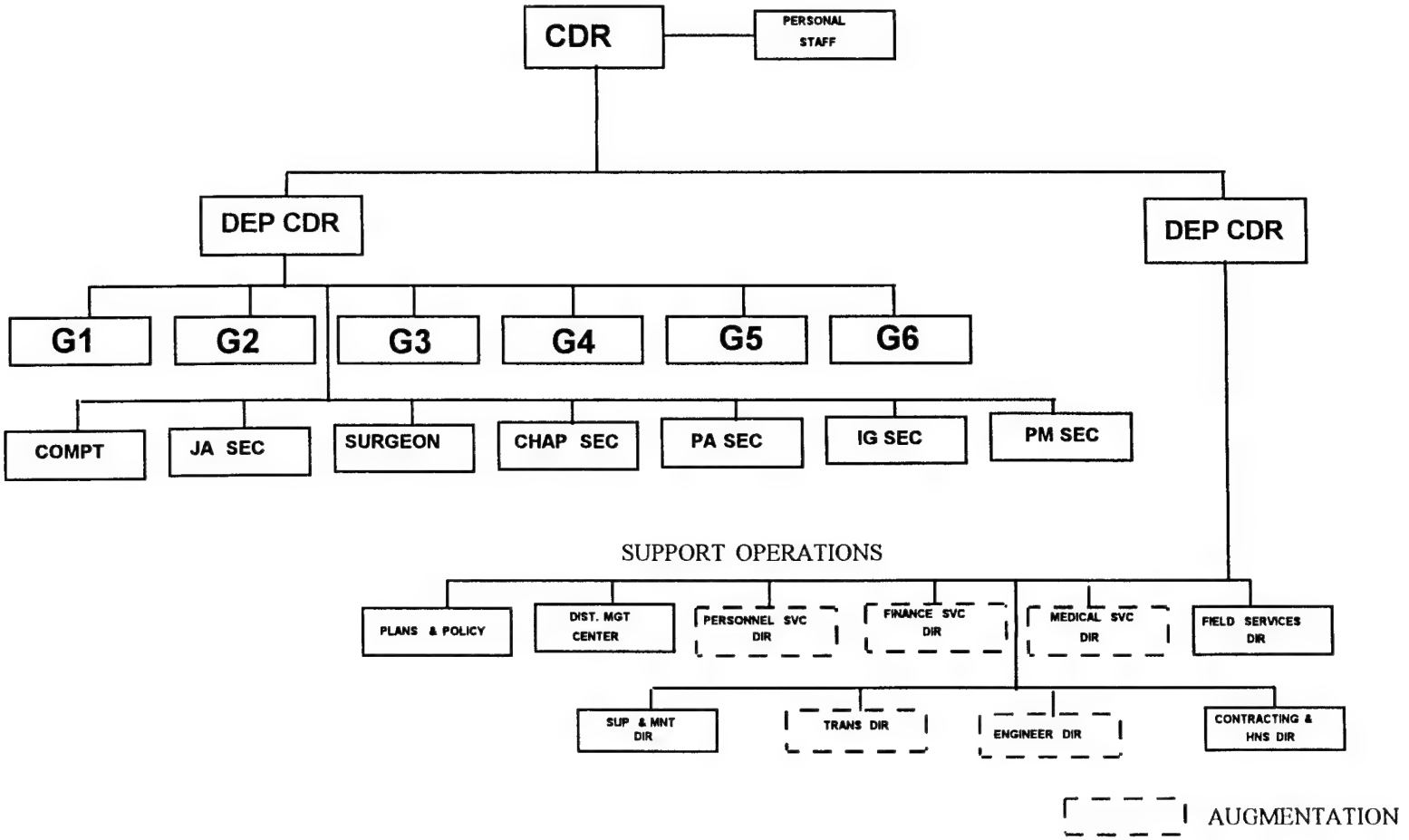
Theater Support Command Concept

The TSC (figure 1) is described and explained in *The Concept for Support Command and Control at Echelons Above Corps*. The TSC is designed to enhance "unity of command under the [Army Service Component Command (ASCC)] since operational control of many support elements can be centralized under one support command. This allows the commander to influence the battle by giving weight and priority of support to the more essential operation(s), depending on the commander's intent."[16]

The formation of the TSC is an attempt to "eliminate the fragmentation of logistic and other support in the Communications Zone (COMMZ) by placing CSS and selected CS functional support under a single commander (supply, maintenance, transportation, engineering, medical, personnel, finance and procurement)."[17] The TSC was designed to "allow the commander greater flexibility in implementing the best course of action in support of the tactical units."[18] The TSC, as proposed in *The Concept for*

Figure 1

Theater Support Command[19]



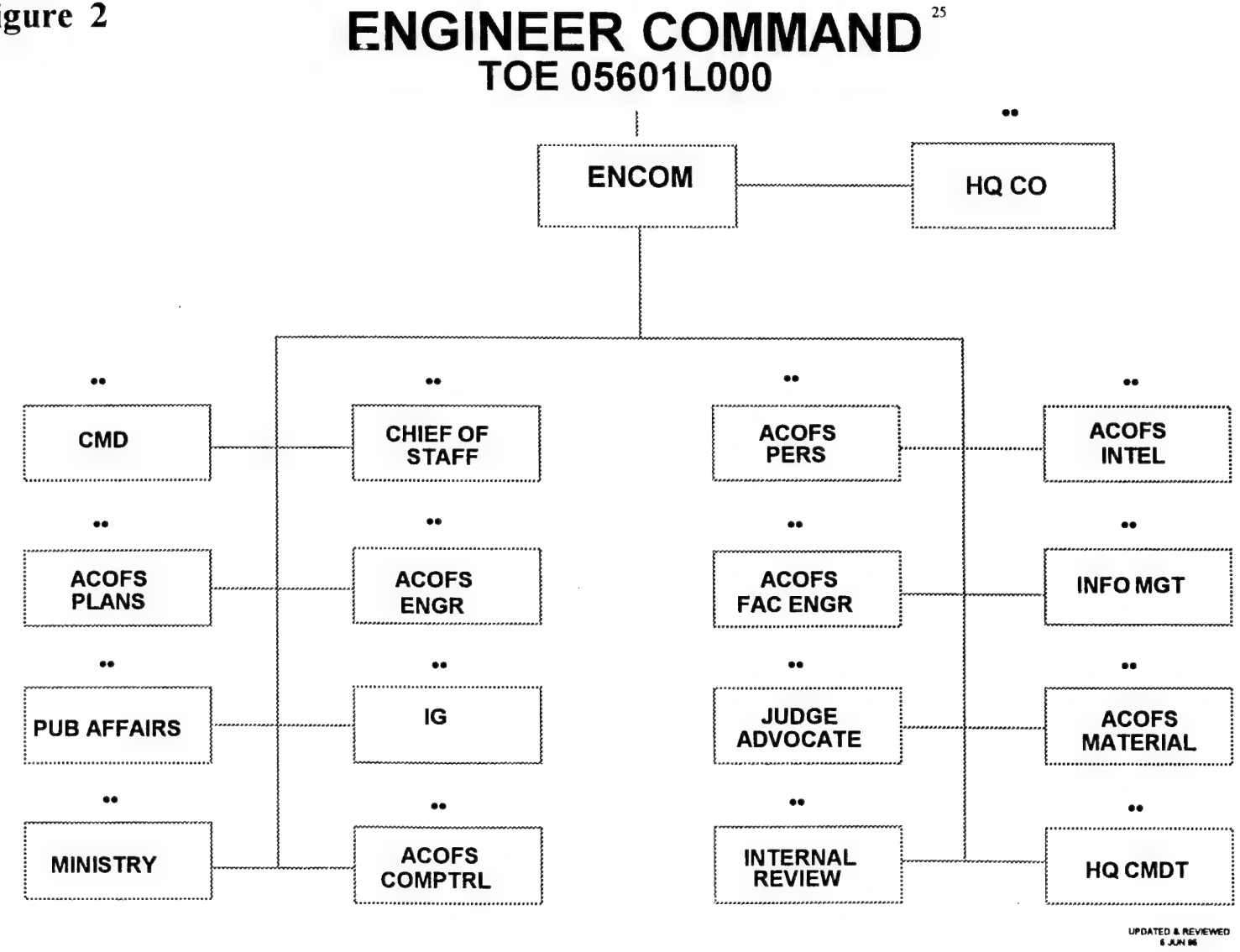
Support Command and Control at Echelons Above Corps, "provides the capability to meld strategic, operational, and tactical logistics through a flexible force."[20] "The modular nature of [the TSC] structure also minimizes strategic lift requirements by allowing the commander to ensure deployment of only essential support elements, to be identifiable with a derivative Unit Identification Code (UIC)."[21]

Theater Engineer Organization

The theater engineer support organization has changed very little since World War II.[22] The key evolutionary changes in the theater ENCOM (figure 2) is that it has become more modular to support the force projection Army,[23] and more capable of serving as a joint/combined engineering force headquarters.[24] Both capabilities-based and multi-functional units are found in the current engineer organizational structure. The capabilities-based engineer units are modular and designed around one particular mission. Examples of these units include:

- Prime Power Battalion
- Pipeline Construction Company
- Port Construction Company
- Engineer Dump Truck Company

Figure 2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- Engineer Bridge Company (Medium Girder, Panel, and Assault Float)
- Utilities Team
- Power Plant Team
- Crash Rescue Team
- Fire-fighting Team
- Quarry Team
- Welldrilling Team
- Diving Team
- Real-estate Team
- Facility Engineer Team
- Terrain Team
- Engineer Planning Team
- Engineer Command and Control Elements[26]

The U.S. Army engineer organizations also include units that are multi-functional by design and perform tactical and operational level engineer missions throughout a theater of operations.[27] Examples of these units include:

- Corps Airborne Combat Engineer Battalion
- Corps Light Combat Engineer Battalion
- Combat Heavy Engineer Battalion

- Corps Mechanized Combat Engineer Battalion
- Engineer Construction Support Company
- Engineer Combat Support Equipment Company
- Engineer Light Equipment Company (Airborne)
- Engineer Light Equipment Company[28]

These engineer units provide support to combat, combat support, and/or combat service support units as required by mission, phase, and/or result. These units are employed throughout theater in a manner similar to the way multi-role and dual-role aircraft are employed by the U.S. Air Force.[29] Engineer effort (mobility, countermobility, survivability, topographic engineering, and general engineering) is "apportioned" to subordinate units based on mission and/or phase. Capabilities-based and multi-functional engineer units are then "allocated" to subordinate commanders to perform specific functions or missions.[30] Even from the very first hours of a force projection operation, capabilities-based and multi-functional engineer units are flexibly employed throughout the entire theater to maximize the engineer support to the over-all ASCC's plan.

Three things have forced the U.S. Army Corps of Engineers to adopt multi-functional engineer units. First, the U.S. Department of Defense cannot afford the force structure (personnel and equipment) increases needed to make

all engineer units modular and designed around only one capability or function.[31] Second, current strategic lift limitations demand multi-functional and multi-capable engineer units.[32] And third, a theater engineer command provides the most efficient way for the ASCC to employ the limited multi-functional engineer units in theater.[33]

There are two command and control organizational models that are similar to the one used to provide current theater engineer support. The first is the Joint Forces Air Component Command (JFACC) model. The second is the TSC model discussed earlier in this monograph.

JFACC Model

Theater Engineer support to a theater of operations as described in *FM 5-116, Engineer Operations: Echelons Above Corps* is similar to how the (JFACC) provides support in a theater of operations. "Since World War II, [theater commanders] have relied on theater air commanders to:

- integrate the air power capabilities of different nations and services,
- devise ways to exploit the different capabilities of the available air assets while reducing their limitations,
- plan operations that maximize the total combat power and synergy of the aggregate air effort,
- and, consequently conduct an effective theater air campaign."[34]

The U.S. Air Force believes that "unity of effort through centralized control of theater air assets [by the JFACC] is the most effective way to employ air power.[35] The JFACC provides a Joint Force Commander (JFC) the means to exploit the capabilities of air power in a theater air campaign."[36] "A divided air effort [in theater is not considered to] cover more bases - [because] it exposes forces to combat with reduced chance of success.[37]

"For surface forces to fight effectively at the theater level they must divide the overall effort geographically. Their large formations, plans, and operations depend on geographical methods of control. In contrast, air forces possessing theater-wide range divide their efforts by mission, campaign phase, and result."[38] "Centralized control of theater air [assets] provides unity of effort, optimizes weapons systems and target pairing, minimizes possibility of fratricide, and ensures unity of command to prioritize competing demands on limited air assets."[39]

Current theater engineer support doctrine recognizes that since World War II theater commanders have relied on ENCOMs to:

- integrate the engineer capabilities of different nations and services,
- devise ways to exploit the different capabilities of the available engineer assets while reducing their limitations,
- plan operations that maximize the total combat power and synergy of the aggregate engineer effort,

- and, consequently provide effective theater wide engineer campaign support.[40]

The U.S. Army Corps of Engineers believes that unity of effort through centralized control of theater engineer assets by the theater engineer commander is the most effective way to employ engineer assets. The theater engineer provides the theater commander with the means to exploit the engineer capabilities throughout the entire theater.[41] Divided engineer effort in theater is not considered to cover more bases - because it dilutes the massing of critical engineer effort with reduced chance of success.[42] It is understood by the U.S. Army Corps of Engineers that for many combat and combat service support forces to fight effectively at the theater level they must divide the overall effort geographically. Their large formations, plans, and operations depend on geographical methods of control. In contrast, the theater engineer commander often apportions engineer effort by mission, campaign phase, and result.[43] Centralized control of theater engineer assets provides unity of effort, optimizes engineer capability and mission pairing, maximizes engineer productivity throughout the theater, and ensures unity of command to prioritize competing demands on limited engineer assets.[44]

Theater Support Command Model

The TSC organizational model was designed to enhance "unity of command under the ASCC since operational control of many support elements can be centralized under one support command. This allows the commander to influence the battle by giving weight and priority of support to the more essential operation(s), depending on the commander's intent."[45]

Similarly, the theater ENCOM was designed to enhance unity of command under the ASCC since operational control of many engineer functions can be centralized under one engineer command. This allows the ASCC commander to influence the battle by giving weight and priority of support to the more essential operations, depending on the commander's intent. The ENCOM eliminates the fragmentation of engineer units providing support to combat, combat support, and combat service support units throughout the theater in the engineer battlefield functional areas of mobility, counter-mobility, survivability, topographic engineering and general engineering.[46] The ENCOM also allows the ASCC commander greater flexibility in implementing the best course of action in support of the tactical units.[47] The ENCOM provides the capability to meld operational and tactical engineer support through a flexible engineer force.[48] The modular and multi-functional nature of the ENCOM structure also minimizes strategic lift

requirements by allowing the commander to deploy only essential engineer elements and units.[49]

Theater Military Engineering

The term "engineering" is defined for use in this monograph as military activities that provide the engineer battlefield functions of mobility, counter-mobility, survivability, topographic engineering, and general engineering to a supported force in the theater of operations.[50] The multi-functional engineer units (and many modular, capabilities-based engineer units) in a theater of operations can be involved in one or more of these engineer battlefield functions in any geographic region, as required by mission, phase, and/or result.[51]

This definition differs from the joint definition of "general engineering" which is focused only on one engineer battlefield function.[52] *Joint Publication 4-0, Doctrine for Logistic Support of Joint Operations,* defines "general engineering" as the logistics function that "provides the construction, damage repair, and operation and maintenance of facilities or logistic enhancements."[53]

Related Research and Analysis

The Office of the Deputy Chief of Staff for Simulations and Analysis, Headquarters, TRADOC published an independent study entitled *Engineer Command Relation to the Theater Support Command* in August 1996. The "study addressed the

command, control, and operational benefits of including an Army Engineer Command (ENCOM) and its early entry modules in a Theater Support Command (TSC) versus keeping the ENCOM as a separate Major Subordinate Command directly under the Army Service Component Commander (ASCC)."[54] "The study was performed as part of the Prairie Warrior (PW) 96 Advanced Warfighting Experiment (AWE)."[55] The study addressed the following questions:

- "What are the benefits and problems associated with inclusion of the ENCOM under the TSC and as a separate [Major Subordinate Command (MSC)] directly under the ASCC?

- Can the ENCOM respond to the [Commander in Chief (CINC)] and ASCC needs more effectively and efficiently as part of the TSC or as a separate MSC?

- What is the recommended chain of command for the ENCOM within a theater of operations?"[56]

The study's principle conclusions included:

- The ENCOM perceived a "loss of their ability to see and support the forward fight and placement of the ENCOM under the TSC added "an unnecessary layer on a working organization."[57]

- "Early entry operations and non-combat operations show a potential for value added in having the Engineer Directorate within the TSC."[58]

- Major Regional Contingencies (MRCs) and extended large scale operations may often require deployment of the full ENCOM as a separate command."[59]

- "METT-T[60] should determine the parts of the TSC and the ENCOM selected to participate in an operation."[61]

Summary

Current literature indicates that future U.S. Army organizations will need to be made up of modular, capabilities-based units designed around core wartime missions. Force XXI combat service support units at all echelons will need to be both tailorable and modular to ensure rapid deployability and operational agility. The TSC design incorporates modularity and other emerging design principles for the force projection Army of the twenty-first century.

The TSC is an attempt to "eliminate the fragmentation of logistic and other support in the Communications Zone (COMMZ) by placing CSS and selected CS functional support under a single commander (supply, maintenance, transportation, engineering, medical, personnel, finance and procurement)."[62] The TSC design allows the commander greater flexibility and "provides the capability to meld strategic, operational, and tactical logistics through a flexible force."[63] "The modular nature of [the TSC] structure also minimizes strategic lift requirements by allowing the commander to ensure deployment of only essential support elements."[64]

The concept of theater engineer support (mobility, counter-mobility, survivability, topographic engineering,

and general engineering) has undergone two key evolutionary changes. The ENCOM has become more modular to support force projection,[65] and doctrinally more capable of serving as a joint/combined engineering force headquarters.[66] Currently both capabilities-based, and multi-functional units are found in the current engineer organizational structure. Force structure caps, limited strategic lift assets, and the need for efficient employment of engineer assets have resulted in the current hybrid (capabilities-based and multi-functional) and hierarchical engineer organizations.[67]

Related research and analysis indicates that a somewhat robust engineer command and control capability under the TSC, particularly in early entry and non-combat operations, greatly enhances the capability of the TSC.[68] Previous research and analysis also indicated that large scale operations may require the ASCC to have a robust theater engineer command and control capability.[69] The next chapter will attempt to determine what organizational characteristics the theater logistics organization must have to best meet the military engineering needs of the force projection Army of the twenty-first century based on insights gained from recent advanced warfighting experiments.

CHAPTER 3 - ANALYSIS

This chapter accomplishes five things. First, it describes the theater support command organizations that were experimented with in the Prairie Warrior 95 and 96 Advanced Warfighting Experiments (AWEs). Second, it identifies the key observations made by the TRADOC Combined Arms Assessment Team regarding theater engineer support and the TSC during these exercises. Third, it analyzes the key observations from the Prairie Warrior 95 and 96 exercises to identify what organizational characteristics that the theater organization must have to best meet the military engineering needs of the force projection Army of the twenty-first century. Fourth, it identifies five points of friction[70] which interfere with resolving the issue the future theater engineer organizational force structure. And fifth, it describes two findings that are relevant to the organizational design and doctrine of the theater engineer force of the twenty-first century.

Theater Support Command

The Theater Support Command organization structure was experimented with in the Prairie Warrior 95 and 96 exercises. Both exercises were very similar (a joint and

combined operation involving two U.S. Corps and a division-sized U.S. Mobile Strike Force in a European environment).[71] In 1995 the Theater Support Command

> was organized similar to [a] Corps Support Command (COSCOM) with a general and special staff responsible for internal operations of the TSC and a support operations office responsible for sustainment to theater... The sustaining functions of personnel, finance services, health service support, and transportation were staffed within the TSC by functional modules pulled from parent Army Commands, ie., the Personnel Command (PERSCOM), the Finance Command (FINCOM), the Medical Command (MEDCOM), the Transportation Command (TRANSCOM). The Logistics Support Element (LSE) was attached to the TSC from the Army Material Command (AMC). The LSE retained a technical chain of command with AMC and other appropriate strategic level organizations and this proved to be a value-added element to operations. The TSC also collocated the material management and movement management and called it the Central Distributed Management Activity (CDMA). The CDMA [was] simply a collection of three separate functions. These [were]: the TSC Material Management Center (MMC), which was formally the TAACOM[72] MMC; elements of the Medical Logistics Management Center, which was formally Medical Material Management Center; and movement management functions from the TSC Movement Control Agency, formally the Theater Army Movement Control Agency. The collocation of these functions within the support operations enabled the operations officer to serve as the distribution manager at" Echelons Above Corps (EAC).[73]

The Theater Support Command organization experimented with in the Prairie Warrior 96 exercise was very similar to

the TSC organizational structure in the Prairie Warrior 95 exercise except that the TSC included the theater ENCOM. In 1996,

> the TSC... [was] a CASCOM[74]-proposed organizational redesign to develop a flexible and adaptable command structure for force projection and sustainment in a theater of operations. CASCOM developed the TSC organization to meet the need to project an appropriate [Command and Control (C2)] structure at EAC. The TSC [was] a multifunctional organization of support functions under a single command. This structure centralizes C2 of these functions at EAC level. The concept place[d] several theater level functions, including the Engineer Command (ENCOM), under the TSC. By way of example, the TSC manage[d] the subordinate functions, such as the engineer function, through a module provided by the functional command. As the situation mature[d], the Army Service Component Commander (ASCC) may [have] elect[ed] to deploy the remainder of those commands in order to reduce the span of control of the TSC commander and to provide additional senior level expertise in the theater. This organizational redesign provide[d] a modular structure to enable the ASCC to put organizational "plugs" in or expand segments out of the TSC.[75]

Prairie Warrior 95 Observations

The *Prairie Warrior `95 Initial Impressions Report* identified two major observations made by the Combined Arms Assessment Team regarding theater engineer support and the TSC. First, the Prairie Warrior 95 exercise "validated the position of an independent senior theater engineer command and control structure" under the ASCC.[76] Second, "the

theater support command [without an ENCOM, was able to provide] synchronized support on an area basis through its subordinate organizations to all Army forces located in or passing through the COMMZ."[77]

Prairie Warrior 96 Observations

The *Prairie Warrior 96 Advanced Warfighting Experiment (PW 96 AWE) Final Report* identified eleven major observations by the Combined Arms Assessment Team regarding theater engineer support and the TSC:

- "Lesser regional contingencies (LRC), early entry operations, and non-combat operations show a potential for value added in having the Engineer Directorate within the TSC."[78]

- "The TSC should be established as the primary organization responsible for planning support to early entry and LRC operations, with an Engineer Directorate as part of the organization."[79]

- The TSC held onto the ENCOM for four months in the notional exercise. This was long after the situation had evolved into a major regional contingency that required a theater engineer command and control capability directly under the ASCC.[80]

- "The exercise highlighted the need for the [TSC] concept to specify guidelines on how to separate the ENCOM and other functional commands as major subordinate commands for MRC operations."[81]

- "The TSC concept does not clearly identify the responsibility of the theater engineer directorate to support engineer operations for... corps and divisions."[82]

- "Having the theater ENCOM under the direct control of the TSC resulted in inefficiencies and slow response to forward theater engineer requirements."[83]

- The TSC concept conflicted with keystone engineer doctrine - the "ENCOM C2 element must focus on reinforcing and augmenting corps engineer efforts."[84]

- Competing requirements for an engineer bridge unit between the TSC for LOC maintenance and a forward division for tactical mobility required resolution at the ARFOR, CFLCC, and CJTF levels which ultimately delayed tactical operations.[85]

- CINC priorities for engineer support and effort conflicted with the general engineering priority in the COMMZ established by the TSC. This caused the subordinate ENCOM element to contend with conflicting priorities of engineer support and effort in theater.[86]

- "Habitual relationships" should be "actively developed in training given the establishment of standing TSCs."[87]

- "There is a benefit from having an identified and organized support command in that all players train together and prepare for early entry operations as a unit."[88]

Observation Analysis

An analysis of the key observations from the Prairie Warrior 95 and 96 exercises indicate three things regarding the TSC and theater engineer support. First, the TSC requires an engineer command and control element primarily focused on early entry operations and the engineer

battlefield function of general engineering in the COMMZ. Second, the ASCC requires an engineer command and control (and/or planning) capability focused on the engineer battlefield functions of mobility, counter-mobility, survivability, topographic engineering and general engineering in support of the theater-wide engineer effort, particularly in a major regional contingency. Third, engineer command and control elements should habitually train with their parent TSC or ASCC headquarters.

The observations from the 96 Prairie Warrior exercise indicated that the TSC needs an engineer command and control (and/or planning) capability designed to support early entry operations and perform the engineer battlefield function of general engineering in the COMMZ. The Combined Arms Assessment Team indicated that lesser regional contingencies, early entry operations, and operations other than war have a large general engineering requirement and will likely require an engineer command and control element to be deployed early on with the TSC. Conceivably there are numerous contingencies which would not warrant the deployment of the full ASCC engineer command and control element.[89]

The Theater Support Command was designed to replace the Theater Army Area Commands (TAACOMs) which had, due to demonstrated operational engineer requirements, a relatively large organic engineer cell designed to support the general engineering effort in the COMMZ. This requirement for an

organic engineer cell to support the general engineering effort in the COMMZ did not go away when the TSC replaced the TAACOM organizations.[90] Also, the TSC did not relinquish control of the engineer directorate to the ASCC months after the 96 Prairie Warrior exercise situation developed into a major regional contingency.[91] This is a future indication that the TSC needs a dedicated engineer command and control (and/or planning) capability primarily focused on early entry operations and the engineer battlefield function of general engineering in the COMMZ.

The ASCC requires an engineer command and control element focused on the engineer battlefield functions of mobility, counter-mobility, survivability, topographic engineering and general engineering in support of the theater-wide engineer effort, particularly in a major regional contingency. Observations from the Prairie Warrior 95 exercise validated the position of an independent senior theater engineer command and control structure subordinate to the ASCC. Observations from the 96 Prairie Warrior exercise clearly indicated that subordinating the ASCC's engineer command and control element to the TSC hindered and/or delayed tactical operations of the forward corps and divisions because the theater engineer command and control element was not in an organizational position to influence, plan, and direct engineer mobility, counter-mobility, survivability, topographic engineering, and general engineering efforts in supporting the forward corps and

divisions.[92] Also, as observed in the Prairie Warrior 96 exercise, the TSC was primarily focused on the battlefield function of general engineering in the COMMZ while the CINC had established different priorities for engineer effort and support. This caused the theater engineer command and control element, which was subordinate to the TSC, to contend with conflicting priorities of engineer support and effort between the TSC commander and the ASCC.[93]

Engineer command and control (and/or planning) capabilities should habitually train with their parent TSC or ASCC headquarters. Habitual training relationships are a key element in ensuring the readiness of a standing TSC. Particularly there is a benefit from having all players (including the engineer element) train together and prepare for early entry operations as a unit. Having a modular engineer command and control element that can serve as a subordinate unit to the TSC and/or the ASCC hinders the training focus of the engineer element during peace-time training since the military engineering focus of both organizations are quite dissimilar.[94]

Points of Friction

Five key points of friction[95] between the logistics and the engineer communities regarding the TSC concept were identified from analyzing current theater engineer doctrine, the TSC Concept, observations from the Prairie Warrior 95 and 96 exercises, and military correspondence[96] regarding

the TSC Concept. The points of friction fall into the five major categories of doctrine, organization, definition, solution, and concepts. The doctrinal point of friction primarily lies with the engineer community. The U.S. Army Corps of Engineers has a historically-based doctrinal position of focusing its limited theater engineer assets on supporting the forward corps and divisions before the logistics and support units in the COMMZ.[97] The doctrinal concept of attaching engineer units or placing engineer units under operational control of a TSC rather than making engineer assets available as needed in a support relationship is considered to be an inefficient use of limited engineer assets.[98]

The organizational point of friction results from subordinating the theater-wide engineer command and control element to an organization that is primarily focused on general engineering support in the COMMZ. Subordinating a theater-wide engineer command and control element under the TSC violates two of the basic elements of an organization.[99] The first is the element of *goal-direction*.[100] The goals of the theater-wide engineer command and control element are not a sub-set of, nor subordinate to, the goals of the TSC.[101] The second element is an *identifiable boundary*.[102] The TSC centralizes command and control of logistic support functions at echelons above corps[103] with a primary focus in the COMMZ.[104] The theater-wide engineer command and control element centralizes command and control of all five engineer

battlefield functions in support of the forward corps and divisions plus the COMMZ with the bulk of echelon above division engineer units forward of the division rear boundaries. The geographical mission and focus of the TSC and the theater-wide engineer command and control element are somewhat different.

Observations from the Prairie Warrior 96 exercise also indicated that there was a definitional point of friction between the engineer community and the logistics community regarding the definition of engineering support. The independent study, *Engineer Command Relation to the Theater Support Command,* conducted by Headquarters, TRADOC found that the TSC Concept "focuses theater engineer capabilities on engineer support to the sustainment base for the theater. The concept does not reference any focus on the combat engineer."[105]

The TSC definition of engineering is primarily based on the engineer battlefield function of general engineering in the communications zone.[106] The TSC definition is in line with current joint logistics doctrine. According to *Joint Publication 4-0, Doctrine for Logistic Support of Joint Operations,* general engineering is defined as the logistics function that "provides the construction, damage repair, and operation and maintenance of facilities or logistic enhancements."[107]

The *Joint Publication 4-0, Doctrine for Logistic Support of Joint Operations* is operationally and

organizationally incompatible with current U.S. Army Corps of Engineers Doctrine.[108] The term engineering is defined by the U.S Army Corps of Engineers as military activities that provide the battlefield functions of mobility, counter-mobility, survivability, topographic engineering, and general engineering to a supported force throughout the theater of operations.[109] The multi-functional engineer units (and many modular, capabilities-based engineer units) in a theater of operations can be involved in one or more of these engineer battlefield functions in any geographic region, as required by mission, phase, and/or result.[110]

The solutional point of friction arises from TRADOC only considering two possible alternatives to the theater engineer organization in regard to the TSC concept. The two organizational alternatives are: "The ENCOM as a separate MSC reporting directly to the ASCC"; or the ENCOM as "an element of the TSC or a subordinate MSC reporting to the Commander, TSC."[111] Limiting the solution to only two possible outcomes is a classic example of a false dilemma.[112] It is likely that both the TSC and the ASCC need engineer command and control (and/or planning) capability. The TSC may require an engineer command and control (and/or planning) capability that is modular and specifically tailored to meet the TSC's general engineering function in the COMMZ. Likewise, the ASCC may need an engineer command and control element that is modular and specifically tailored to meet the ASCC's requirement to support the

forward corps and divisions plus the TSC with the battlefield functions of mobility, countermobility, survivability, topographic engineering, and general engineering.

Conceptually there are differences between the organizational concept of modularity used in the TSC and the multi-functional nature of many engineer units and organizations. These conceptual differences in organizational design creates another point of friction. Many engineer units are not designed around one engineer battlefield function such as general engineering. The multi-functional design of these engineer units require a higher headquarters to efficiently employ them throughout the theater to support the ASSC's priorities.[113] Theoretically, the JFACC-like engineer command and control element at the theater level would be more efficient and responsive to the needs of the ASCC if it was a subordinate command directly under the ASCC.[114] Similar friction would arise between the air force and a theater air defense command if the JFACC was placed subordinate to a theater air defense command (which would be focused only on one air force function). Multi-functional organizations are not efficiently used if placed under a functional headquarters such as the TSC.[115]

Findings

There are two findings that emerge as a result of analyzing the observations from the Prairie Warrior 95 and 96 exercises and points of friction regarding the issue of the ENCOM in the TSC Concept. First, the TSC requires a habitually associated, modular and tailorable engineer command and control (and/or planning) capability that is primarily focused on the function of general engineering in the COMMZ. This modular and tailorable engineer command and control headquarters must be able to be deployed in whole or in part depending on METT-T, and must be capable of serving as the ASCC's theater engineer command and control element headquarters when required by the ASCC. Second, the ASCC also requires a habitually associated, modular and tailorable engineer command and control element that is focused on the functions of mobility, counter-mobility, survivability, topographic engineering and general engineering throughout the theater. This modular and tailorable engineer command and control headquarters must be able to be deployed in whole or in part, depending on METT-T. It must also be capable of efficiently managing the multi-functional engineer units throughout theater in order to support, and be responsive to, the ASCC's scheme of operations and priorities.

CHAPTER 4 - CONCLUSION AND SUMMARY

Current literature indicated that future U.S. Army organizations will need to be made up of modular, capabilities-based units designed around core wartime missions. Two different TSC organizations were looked at in the context of the Prairie Warrior 95 and 96 exercises. In the Prairie Warrior 95 exercise, the theater ENCOM was subordinate to the ASCC. And, in the 96 Prairie Warrior exercise the theater ENCOM was subordinate to the TSC. Key observations made by a TRADOC Combined Arms Assessment Team during the Prairie Warrior exercises were analyzed to determine what organizational characteristics the theater organization should have to best meet the engineering needs of the force projection Army of the twenty-first century. Five points of friction were also identified that are interfer with resolving the future theater engineer organization within TRADOC.

Summary of the Findings

There were two findings that resulted from analyzing the observations from the Prairie Warrior 95 and 96 exercises and points of friction regarding the issue of the ENCOM in the TSC Concept. First, the TSC requires a

habitually associated, modular and tailorable engineer command and control (and/or planning) capability that is primarily focused on the function of general engineering in the COMMZ. This modular and tailorable engineer command and control headquarters must be able to be deployed in whole or in part depending on METT-T. It must also be capable of serving as the ASCC's theater engineer command and control element headquarters when required by the ASCC.

Second, the ASCC requires a habitually associated, modular and tailorable engineer command and control element that is focused on the functions of mobility, counter-mobility, survivability, topographic engineering and general engineering throughout the theater. This modular and tailorable engineer command and control headquarters must be able to be deployed in whole or in part depending on METT-T. The engineer command and control headquarters must also be capable of efficiently managing the capabilities-based and muti-functional engineer units in order to support, and be responsive to, the ASCC's scheme of operations and priorities.

These findings are similar to the findings in the independent study entitled *Engineer Command Relation to the Theater Support Command* except that this study was not limited to just two alternatives. The authors of the *Engineer Command Relation to the Theater Support Command* agreed "that the `support functions' of the TSC cluster around [the] logistics business and provide services for the

troops and force."[116] This general engineering function of the engineer force is a legitimate concern of the TSC commander and some engineer command and control capability is needed to manage it.

The findings from this study also support comments made by a current Warfighting Commander in Chief (CINC) and ASCC. The U.S. Central Command and U.S. Army Europe, in recent correspondence regarding the TSC concept, recognized the need to retain a habitually associated, modular and tailorable engineer command and control element subordinate to the ASCC that is focused on providing the functions of mobility, counter-mobility, survivability, topographic engineering and general engineering throughout the theater.[117] The *Engineer Command Relation to the Theater Support Command* did compare the engineer mission to the "signal corps and chemical" combat support elements. The study noted that "these [combat support] elements are not included in the TSC concept" and that these elements (much like the engineers) provide something other than a logistics support function.[118] Engineers are very similar to the other combat support organizations and may better serve the Army as a distinct combat support headquarters element directly under the ASCC.[119]

The findings of this study also support the TSC concept in its goal of reducing the number of headquarters and support units in the COMMZ and minimizing "strategic lift requirements."[120] The findings, if implemented, would (in

some scenarios) reduce the number of engineer headquarters and engineer units in the COMMZ by establishing one central engineer headquarters or element (subordinate to the TSC) for the COMMZ general engineering effort (instead of the multiple ones specified in current engineer doctrine).[121] The findings also support the minimizing of "strategic lift requirements by allowing a commander to" deploy only essential engineer modules.[122]

Limitations of this Research

This research was limited because it only looked at observations[123] from two exercises which utilized the TSC organization. In the Prairie Warrior 95 exercise, the theater ENCOM was subordinate to the ASCC and in the 96 exercise the theater ENCOM was subordinate to the TSC. The Prairie Warrior exercises were unable to fully test the TSC concept during early entry operations because the major portion of the exercises took place after the theater was mature.[124] Also, since the Prairie Warrior exercise is the capstone exercise for students at the U.S. Army Command and General Staff College, the exercise does not have the full benefit of trained and experienced staffs and commanders during execution.[125] Additionally, the confederation of models used during the Prairie Warrior exercises poorly replicated engineer battlefield functions which limited the utility of the exercise for determining the optimum engineer organization for theater.[126] Finally, the TSC organization

was one of many sub-experiments in the Prairie Warrior exercises which limited the value and depth of the observations and findings by the Combined Arms Assessment Team.[127] Despite these limitations, the Prairie Warrior 95 and 96 exercises were the first two major exercises where the TSC operated as described in the TSC Concept. The observations from these two exercises do provide some insight into future requirements for the theater engineer organizational structure.

Further Research

The findings described in this monograph were based primarily on observations from two Prairie Warrior exercises and should only be used as a basis for further research and experimentation. Further research and experimentation is needed to help refine the theater engineer organization. Additional exercises should be developed and designed specifically to test the TSC concept and the theater engineer organizational structures.[128]

Conclusion

Modularity will influence the evolution of the U.S. Army Corps of Engineers at echelons above division. But, force structure restrictions and strategic lift limitations will prohibit most engineer units at echelon above division to be designed around just one engineer battlefield capability. The limited number of multi-functional engineer

units normally available requires centralized control at theater to ensure efficient employment.

During certain situations it may make sense to put the theater engineer structure under a TSC to eliminate redundant headquarters, centralize control of limited logistics support units, and make theater support units more deployable and responsive. METT-T analysis may dictate that engineer organizations be under the command and/or control of combat service support units as they routinely are with combat units. Placing the theater engineer command and control organization under a theater support command may also be the best way to tailor a rapidly deployable, theater support organization to meet the logistics requirements of early entry operations and some operations other than war.

But, the ASCC commander will also likely require a habitually associated, modular and tailorable engineer command and control element that is focused on the functions of mobility, counter-mobility, survivability, topographic engineering and general engineering throughout the theater. This modular and tailorable engineer command and control headquarters must be able to be deployed in whole or in part depending on METT-T. The ASCC engineer command and control element must also be capable of efficiently managing the capabilities-based and multi-functional engineer units throughout the theater in order to support, and be responsive to, the ASCC's scheme of operations and priorities.

APPENDIX A

GLOSSARY

Battlespace - Components of this space are determined by the maximum capabilities of friendly and enemy forces to acquire and dominate each other by fires and maneuver and in the electromagnetic spectrum.[129]

Force Projection - The movement of military forces from CONUS or a theater in response to requirements of war or operations other than war; force-projection operations extend from mobilization and deployment of forces, to redeployment to CONUS or home theater, to subsequent demobilization.[130]

Full-dimensional Operations - The application of all capabilities available to an Army commander to accomplish his mission decisively and at the least cost across the full range of possible operations.[131]

Information Operations - Continuous combined arms operations that enable, enhance, and protect the commander's decision cycle and execution while influencing an opponent's; information operations are accomplished through effective intelligence, command and control, and command and control warfare operations, supported by all available friendly information systems; battle command information operations are conducted across the full range of military operations.[132]

Modular Designed Elements (Modularity) - Organizations constructed with discrete elements of specific capabilities. The elements are specific parts/elements of the organization and, when combined, create the functional capability of the unit. each subordinate element does not mirror the functional capability of the entire unit.[133]

Tailorability - Capability to determine the right mix and sequencing of units with sufficient combat power to accomplish the mission and sustain the force, based on METT-T, analysis, and other criteria such as available lift, pre-positioned assets and host nation support.[134]

APPENDIX B

ABBREVIATIONS

ACOFS	Assistant Chief of Staff
AMC	Army Material Command
ARFOR	Army Forces Commander
ASCC	Army Service Component Commander
AWE	Advanced Warfighting Experiment
C2	Command and Control
CAAT	Combined Arms Assessment Team
CASCOM	Combined Arms Support Command
CDMA	Central Distributed Management Activity
CFLCC	Combined Forces Land Component Commander
CINC	Commander in Chief
CJTF	Combined Joint Task Force
CDR	Commander
CHAP	Chaplain
CMD	Command
CMDT	Commandant
COMMZ	Communications Zone
COMPT[RL]	Comptroller
COSCOM	Corps Support Command
CS	Combat Support
CSS	Combat Service Support
DIR	Director or Directorate
DIST	Distribution
DEP	Deputy
EAC	Echelons Above Corps
EAD	Echelons Above Division

ENCOM	Engineer Command
ENGR	Engineer
FAC	Facility
FINCOM	Finance Command
HQ	Headquarters
IG	Inspector General
INFO	Information
INTEL	Intelligence
JA	Judge Advocate
JFACC	Joint Forces Air Component Commander
JFC	Joint Forces Commander
LOC	Lines of Communication
LRC	Lesser Regional Contingency
LSE	Logistics Support Element
MEDCOM	Medical Command
METT-T	Mission, Enemy, Time, Terrain, and Troops
MMC	Material Management Center
MNT	Maintenance
MRC	Major Regional Contingency
PA	Public Affairs
PERS	Personnel
PERSCOM	Personnel Command
PM	Provost Marshall
PUB	Public
PW	Prairie Warrior
SEC	Section
SUP	Support
SVC	Services
TAACOM	Theater Army Area Command
TOE	Tables of Organization and Equipment
TRADOC	U.S. Army Training and Doctrine Command
TRANSCOM	Transportation Command
TSC	Theater Support Command
UIC	Unit Identification Code

ENDNOTES

1. U.S. Army Training and Doctrine Command, *TRADOC Pamphlet 525-5, Force XXI Operations,* (Ft. Monroe, VA., August 1994), Chapter 3.

2. Ibid.

3. U.S. Army Training and Doctrine Command, *Engineer Command Relation to the Theater Support Command, (Office of the Deputy Chief of Staff for Simulations and Analysis,* Ft. Monroe, VA., September 4, 1996), 15-18.

4. Ibid., 14-18.

5. U.S. Army Combined Arms Support Command, *Concept for Support Command and Control at Echelons Above Corps,* (Ft. Lee, VA., October 1, 1996).

6. Ibid., 3.

7. U.S. Army Training and Doctrine Command, *TRADOC Pamphlet 525-68, Concept for Modularity,* (Ft. Monroe, VA., January 1995).

8. U.S. Army Combined Arms Support Command, *Concept for Support Command and Control at Echelons Above Corps,* Appendix I.

9. U.S. Army Training and Doctrine Command, *Engineer Command Relation to the Theater Support Command,* 4.

10. Ibid., 18-20.

11. U.S. Army Training and Doctrine Command, *TRADOC Pamphlet 525-5,* 4-5.

12. Ibid.

13. Ibid.

14. U.S. Army Training and Doctrine Command. *TRADOC Pamphlet 525-68, Concept for Modularity,* 5.

15. John E. Miller, "Force XXI - Vision for Change," *Military Review,* (May-June 1995), 1.

16. U.S. Army Combined Arms Support Command, *Concept for Support Command and Control at Echelons Above Corps,* 9.

17. Ibid.

18. Ibid.

19. Ibid., 15.

20. Ibid., 9.

21. Ibid., 3.

22. Blanch D. Coll, Jean E. Keith and Herbert H. Rosenthal, *United States in World War II, The Technical Services: The Corps of Engineers: Troops and Equipment,* (Washington D.C.: Office Office of the Chief of Military History, 1958).

23. Department of the Army, *Field Manual 5-116, Engineer Operations: Echelons Above Corps (Initial Draft),* (Washington, D.C., November, 1996), 3-2 thru 3-3.

24. U.S. Army Engineer School, *Engineer Concept for EAC Command and Control,* (Ft. Leonard Wood, MO., March 5, 1996), 3-4.

25. Diagram was obtained from the Directorate of Combat Developments, U.S. Army Engineer School on 6 February 1997.

26. Department of the Army, *Field Manual 5-116, Engineer Operations: Echelons Above Corps (Initial Draft),* Appendix A.

27. Ibid., 1-9 thru 1-13.

28. Ibid., Appendix A.

29. Headquarters, United States Air Force, *JFACC Primer,* (Pentagon, Washington, D.C., February 1994)., 14-27.

30. Ibid., 16-17.

31. Based on the author's analysis of the current active and reserve component engineer force structure.

32. Department of the Army, *Field Manual 5-116, Engineer Operations: Echelons Above Corps (Initial Draft),* 3-2 thru 3-8.

33. Richard L. Daft, *Organization Theory and Design*, (New York: West Publishing Company, 1989), 226-230.

34. Headquarters, United States Air Force, *JFACC Primer*, 1.

35. Ibid., 31.

36. Ibid., 1.

37. Ibid., 8.

38. Ibid.

39. Ibid., 34.

40. U.S. Army Engineer School, *Engineer Concept for EAC Command and Control*, 3-4.

41. Ibid., 3.

42. Department of the Army, *Field Manual 5-116, Engineer Operations: Echelons Above Corps (Initial Draft)*, 1-12.

43. Ibid., 1-9 thru 1-13.

44. Ibid.

45. U.S. Army Combined Arms Support Command, *Concept for Support Command and Control at Echelons Above Corps*, 9.

46. Department of the Army, *Field Manual 5-116, Engineer Operations: Echelons Above Corps (Initial Draft)*, 1-9 thru 1-13.

47. U.S. Army Engineer School, *Engineer Concept for EAC Command and Control*, 3.

48. Department of the Army, *Field Manual 5-116, Engineer Operations: Echelons Above Corps (Initial Draft)*, 1-9 thru 1-13.

49. Ibid., 3-2 thru 3-3.

50. Department of the Army, *Field Manual 5-100, Engineer Operations*, (Washington, D.C., November 22, 1988), 9-10.

51. U.S. Army Engineer School, *Engineer Concept for EAC Command and Control*, 3.

52. Department of the Army, *Field Manual 5-100, Engineer Operations,* (Washington, D.C., November 22, 1988), 1-8.

53. Joint Chiefs of Staff, *Joint Pub 4-0, Doctrine for Logistic Support of Joint Operations* (Pentagon, Washington, D.C., January 27, 1995), v.

54. U.S. Army Training and Doctrine Command, *Engineer Command Relation to the Theater Support Command,* 1.

55. Ibid.

56. Ibid.

57. Ibid., 18.

58. Ibid.

59. Ibid., 19.

60. See Appendix A.

61. U.S. Army Training and Doctrine Command, *Engineer Command Relation to the Theater Support Command,* 19.

62. U.S. Army Combined Arms Support Command, *Concept for Support Command and Control at Echelons Above Corps,* 9.

63. Ibid.

64. Ibid., 3.

65. Department of the Army, *Field Manual 5-116, Engineer Operations: Echelons Above Corps (Initial Draft),* 3-2 thru 3-3.

66. U.S. Army Engineer School, *Engineer Concept for EAC Command and Control,* 3-4.

67. Daft, 18-19, 233-237.

68. U.S. Army Training and Doctrine Command, *Engineer Command Relation to the Theater Support Command,* 18-19.

69. Ibid., 19

70. "Point of friction" is a phrase used by the author to indicate an unresolved issue that is hindering or complicating the natural evolution of the theater organization.

71. Conclusion drawn by the author who observed the Prairie Warrior 95 exercise and was a student participant in the Prairie Warrior 96 exercise.

72. See Appendix A.

73. Prairie Warrior Combined Arms Assessment Team, *Prairie Warrior `95 Initial Impressions Report*, (Ft. Leavenworth KS., June 2, 1995), 7-2.

74. See Appendix A.

75. U.S. Army Training and Doctrine Command Analysis Center, *Prairie Warrior 96 Advanced Warfighting Experiment (PW 96 AWE) Final Report*, (Ft. Leavenworth, KS., September 1996), 3-2.

76. Prairie Warrior Combined Arms Assessment Team, *Prairie Warrior `95 Initial Impressions Report*, 6-32.

77. Ibid., 7-9.

78. U.S. Army Training and Doctrine Command Analysis Center, *Prairie Warrior 96 Advanced Warfighting Experiment (PW 96 AWE)*, 3-4.

79. Ibid.

80. Ibid., 3-10.

81. Ibid., 3-4.

82. Ibid., 3-10.

83. Ibid.

84. Ibid., 3-11.

85. Ibid.

86. Ibid. 3-11.

87. Ibid., 3-4..

88. Ibid.

89. U.S. Army Training and Doctrine Command, *Engineer Command Relation to the Theater Support Command*, 14-15.

90. Memorandum from Commandant, U.S. Army Engineer School to Commander, U.S. Army Combined Arms Support Command, Subject: *Draft Concept for Support Command and Control at Echelons Above Corps*, undated, 1996.

91. U.S. Army Training and Doctrine Command Analysis Center, *Prairie Warrior 96 Advanced Warfighting Experiment (PW 96 AWE)*, 3-10.

92. Ibid., 3-10 thru 3-11.

93. Ibid., 3-10.

94. Department of the Army, *Field Manual 25-100, Training the Force*, (Washington, D.C., November 15, 1988), 1-3 thru 1-5.

95. "Point of friction" is a phrase used by the author to indicate an unresolved issue that is hindering or complicating the natural evolution of the theater organization.

96. See Correspondence section of Biblography.

97. U.S. Army Training and Doctrine Command Analysis Center, *Prairie Warrior 96 Advanced Warfighting Experiment (PW 96 AWE)*, 3-11.

98. Daft, 226-230.

99. Ibid., 10.

100. Ibid.

101. Department of the Army, *Field Manual 5-116, Engineer Operations: Echelons Above Corps (Initial Draft)*, 1-9 thru 1-13.

102. Daft, 10.

103. U.S. Army Combined Arms Support Command, *Concept for Support Command and Control at Echelons Above Corps*, 11.

104. Ibid., 9.

105. U.S. Army Training and Doctrine Command, *Engineer Command Relation to the Theater Support Command*, 13.

106. Ibid., 16.

107. Joint Chiefs of Staff, *Joint Pub 4-0, Doctrine for Logistic Support of Joint Operations*, 4.

108. Department of the Army, *Field Manual 5-116, Engineer Operations: Echelons Above Corps (Initial Draft)*, Chapter 1.

109. Department of the Army, *Field Manual 5-100, Engineer Operations,* 9-10.

110. Department of the Army, *Field Manual 5-116, Engineer Operations: Echelons Above Corps (Initial Draft),* 1-9 thru 1-13.

111. U.S. Army Training and Doctrine Command, *Engineer Command Relation to the Theater Support Command,* 5.

112. Glen Leggett and others, *Handbook for Writers,* (Englewood Cliffs, New Jersey: Prentice Hall, 1988), 426.

113. Daft, 226-330.

114. Headquarters, United States Air Force, *JFACC Primer,* 8.

115. Daft, 226-330.

116. U.S. Army Training and Doctrine Command, *Engineer Command Relation to the Theater Support Command,* 16.

117. Correspondence from: 1) Commander in Chief, U.S. Central Command to Deputy Chief of Staff for Logistics, Subject: *Draft Concept for Support Command and Control at Echelons Above Corps, May* 15, 1996; 2) Commander, Third U.S. Army to Deputy Chief of Staff for Logistics, Subject: *Draft Concept for Support Command and Control at Echelons Above Corps,* April 3, 1996; and 3) Commander, U.S. Army Europe to Commander, U.S. Army Combined Arms Support Command, Subject: *Draft Concept for Support Command and Control at Echelons Above Corps,* May 21, 1996.

118. Ibid.

119. The establishment of the Maneuver Support Center at Ft. Leonard Wood, MO. is evidence of this.

120. U.S. Army Combined Arms Support Command, *Concept for Support Command and Control at Echelons Above Corps,* 3.

121. Department of the Army, *Field Manual 5-116, Engineer Operations: Echelons Above Corps (Initial Draft),* 2-2 thru 2-5.

122. U.S. Army Combined Arms Support Command, *Concept for Support Command and Control at Echelons Above Corps,* 3.

123. The quantity and depth of observations were somewhat limited. The author considered the observations to be largely subjective and may have reflected the biases of the members of the Combined Arms Assessment Team.

124. Prairie Warrior Combined Arms Assessment Team, *Prairie Warrior `95 Initial Impressions Report*, and U.S. Army Training and Doctrine Command Analysis Center, *Prairie Warrior 96 Advanced Warfighting Experiment (PW 96 AWE) Final Report*.

125. Personal observation by the author.

126. Personal observation by the author.

127. U.S. Army Training and Doctrine Command Analysis Center, *Prairie Warrior 96 Advanced Warfighting Experiment (PW 96 AWE) Final Report*.

128. U.S. Army Training and Doctrine Command, *Engineer Command Relation to the Theater Support Command*, 20.

129. U.S. Army Training and Doctrine Command. *TRADOC Pamphlet 525-5*, G-1.

130. Ibid., G-4.

131. Ibid.

132. Ibid.

133. U.S. Army Training and Doctrine Command. *TRADOC Pamphlet 525-68*, 4.

134. U.S. Army Training and Doctrine Command. *TRADOC Pamphlet 525-5*, G-7.

BIBLIOGRAPHY

Books

Bellamy, Christopher. *The Future of Land Warfare*. New York: St. Martin's Press, 1987.

_____. *The Evolution of Modern Land Warfare*. London: Routledge, 1990.

Bertalanffy, Ludwig von. *General Systems Theory*. New York: George Braziller, Inc., 1968.

Bond, P.S. *The Engineer in War*. New York: McGraw-Hill Book Company, 1916.

Clausewitz, Carl Von. *On War*. Edited and translated by Michael Howard and peter Peret. Princeton, NJ: Princeon University Press, 1984.

Coll, Blanch D., Jean E. Keith and Herbert H. Rosenthal. *United States in World War II, The Technical Services: The Corps of Engineers: Troops and Equipment*. Washington D.C.: Office Office of the Chief of Military History, 1958.

Crump, Irving. *Our Army Engineers*. New York: Dodd, Mead & Company, 1954.

Daft, Richard L. *Organization Theory and Design*. New York: West Publishing Company, 1989.

Davis, Franklin M. Jr, and Thomas T. Jones. *The U.S. Army Engineers - Fighting Elite*. New York: Franklin Watts, Inc., 1967.

Frederick the Great. "The Instructions of Frederick the Great to His Generals." Translated by J. D. Hittle in the *Roots of Strategy*, pp. 301-400. Harrisburg, PA: Stackpole Books, 1987.

The Infantry Journal, Inc. *The Corps of Engineers*. Chicago: Rand McNally and Company, 1943.

Jomini, Antoine Henri. "The Art of War." Translated by J. D. Hittle in the *Roots of Strategy, Book II*, pp. 388-557. Harrisburg, PA: Stackpole Books, 1987.

Kelly, Kevin. *Out of Control*. New York: Addison-Wesley, 1994.

Leggett, Glen and others. *Handbook for Writers*. Englewood Cliffs, New Jersey: Prentice Hall, 1988.

Luthens, Fred. *Organizational Behavior*. New York: McGraw-Hill Book Company, 1989.

Mackenzie, Kenneth D. *Organizational Design: The Organizational Audit and Analysis Technology*. Norwood, New Jersey: Ablex Publishing Corporation, 1986.

Marshall, S.L.A. *Men Against Fire*. Glouchester, MS: Peter Smith, 1978.

Office of the Chief of Military History, U.S. Army. *United States Army in World War II, The Technical Services, The Corps of Engineers: Troops and Equipment*. Washington, D.C., 1958.

Office of History, U.S. Army Corps of Engineers. *Builders and Fighters: U.S. Army Engineers in World War II*. Fort Belvoir VA., 1992.

Sun Tzu. *The Art of War*. Translated by Samuel B. Griffith. New York: Oxford University Press, 1963.

Toffler, Alvin, and Heidi Toffler. *War and Anti-War: Survival at the Dawn of the 21st Century*. New York: Little, Brown and Company, 1993.

Thompson, Paul W. *The Army Engineers*. New York: W.W. Norton and Company, Inc., 1942.

_____. *Engineers in Battle*. Harrisburg: Military Service Publishing Company, 1942.

_____. *Modern Battle*. New York: Penguin Books, 1942.

Turabian, Kate L. *A Manual for Writers*. Chicago: The University of Chicago Press, 1996.

Periodicals and Articles

Anderson, Jerry L. and Robinson, James H., "Joint Forces Engineer Command: A Proposal," *Engineer*, April 1995.

Boyd, Morris J., "Force XXI Operations," *Military Review*, November 1994, 17-28.

Cain, Marion F., III, "Force Projection: Building Desert Storm Force Structure," *Military Review*, July 1993, 20-30.

Davis, Robert L., "Army Engineers: IT's Time to Speak with One Voice," *Engineer*, March 1996.

Frix, Robert S. and Davis, Archie L., III, *Military Review*, October 1992, 2-10.

Heslin, John G., "Mobility: Key to Success on the Extended Battlefield." *Military Review*, August 1981, 57-63.

Holder, L.D. and Edwin J. Arnold, "Moving the Heavy Division." *Military Review*, July 1988, 35-49.

Kem, Richard S., J. Richard Capka, and Houng Y. Soo. "E-Force." *Engineer*, Spring 1986, 6-13.

_____. "E-Force an Update." *Engineer*, July 1988, 10-19.

Madigan, James C., and Dodge, George E., "Battle Command: A Force XXI Imperative," *Military Review*, November 1994, 29-39.

Miller, John E., "Force XXI - Vision for Change," *Military Review*, May-June 1995, 1.

Mulcahy, Terrence D., "Engineer Support in the COMMZ," *Military Review*, March 1992, 14-21.

Pagonis, William G. and Raugh, Harold E. Jr., "Good Logistics is Combat Power: The Logistics Sustainment of Operation Desert Storm," *Military Review*, September 1991, 28-39.

Paparone, Christopher, "Equivalent Theory of Logistics," *Army Logistician*, January-February 1995, 12-17.

Sullivan, Gordon R., "A Vision for the Future," *Military Review*, May-June 1995, 5-14.

_____. "Land Warfare in the 21st Century," *Military Review*, September 1993, 13-22.

Williams, Michael S. and Palmer, Herman T., "Force Projection Logistics," *Military Review*, June 1994, 29-39.

Government Documents, Manuals and Lectures

Center for Army Lessons Learned. *Operation JOINT ENDEAVER Initial Impressions Report*. Ft. Leavenworth, KS., May 1996.

Department of the Army. *Field Manual 5-100, Engineer Operations*. Washington, D.C., November 22, 1988.

_____. *Field Manual 5-104, General Engineering*. Washington, D.C., November 12, 1986.

_____. *Field Manual 5-116, Engineer Operations: Echelons Above Corps (Initial Draft)*. Washington, D.C., November, 1996.

_____. *Field Manual 25-100, Training the Force*. Washington, D.C., November 15, 1988.

_____. *Field Manual 25-101, Battle Focused Training*. Washington, D.C., September 30, 1990.

_____. *Field Manual 100-15, Corps Operations*. Washington, D.C., June 1, 1996.

_____. *Field Manual 100-16, Army Operational Support (Final Approved Draft)*. Washington, D.C., February 17, 1995.

Gill, Clair F. et al. *Engineer Directions: AirLand Battle 2000*. Carlisle Barracks, PA: U.S. Army War College Thesis, 1983.

Headquarters, United States Air Force. *JFACC Primer*. Pentagon, Washington, D.C., February 1994.

Joint Chiefs of Staff. *Joint Pub 4-0, Doctrine for Logistic Support of Joint Operations*. Pentagon, Washington, D.C., January 27, 1995.

Louisiana Maneuvers Task Force. *Force XXI*, Ft. Monroe, VA., January 1995.

Pierce, Kerry K., *E-Force: How Agile Is It?* Ft. Leavenworth KS: School of Advanced Military Studies Monograph, 1986.

Prairie Warrior Combined Arms Assessment Team. *Prairie Warrior `95 Initial Impressions Report*, Ft. Leavenworth KS., June 2, 1995.

Romjue, John L. From Active Defense to AirLand Battle: The Development of Army Doctrine 1973-1982. Ft. Monroe, VA: Historical Office, U.S. Army Training and Doctrine Command, June 1984.

Sullivan, Gordon R., GEN., *Building the Force for the 21st Century-Force XXI*, Chief of Staff of the Army message dated March 8, 1994.

U.S. Army Combined Arms Support Command. Briefing: *An Army Echelons Above Corps Organizational Redesign*. Ft. Lee, VA., June 18, 1996.

U.S. Army Combined Arms Support Command. *Concept for Support Command and Control at Echelons Above Corps*. Ft. Lee, VA., October 1, 1996.

U.S. Army Command and General Staff College. *Student Text 20-10: Master of Military Art and Science (MMAS) Research and Thesis*, Ft. Leavenworth, KS., June 1995.

_____. *Prairie Warrior `95 Combined Arms Assessment Team Final Report, Volume II, Observations*, Ft. Leavenworth KS., November 22, 1994.

_____. *Student Text 22-2: Writing and Speaking Skills for Senior Leaders*, Ft. Leavenworth, KS., April 1991.

U.S. Army Corps of Engineers Museum. *Genesis of the Corps of Engineers*. Ft. Belvoir VA., 1953.

U.S. Army Engineer School. *Engineer 2000*. Ft. Belvoir, VA., February 1991.

_____. *Engineer Concept for EAC Command and Control*. Ft. Leonard Wood, MO., March 5, 1996.

_____. *Engineer Force Structure Master List*. Ft. Leonard Wood, MO., February 1, 1997.

U.S. Army Training and Doctrine Command. *Engineer Command Relation to the Theater Support Command, Office of the Deputy Chief of Staff for Simulations and Analysis*, Ft. Monroe, VA., September 4, 1996.

U.S. Army Training and Doctrine Command. *TRADOC Pamphlet 525-5, Force XXI Operations*, Ft. Monroe, VA., August 1994.

_____. *TRADOC Pamphlet 525-68, Concept for Modularity*, Ft. Monroe, VA., January 1995.

_____. *TRADOC Pamphlet 525-XX, Concept for Information Operations (Coordinating Draft)*, Ft. Monroe, VA., February 1994.

_____. *TRADOC Pamphlet 525-XX, Force XXI Division Operations Concept (Draft)*, Ft. Monroe, VA., February 7, 1995.

U.S. Army Training and Doctrine Command Analysis Center. *Prairie Warrior 96 Advanced Warfighting Experiment (PW 96 AWE) Final Report*, Ft. Leavenworth, KS., September 1996.

Walker, Paul K. *Engineers of Independence*. Washington, D.C.: Office of the Chief of Engineers. Undated.

Correspondence

Commandant, U.S. Army Engineer School to Commander, U.S. Army Combined Arms Support Command. Memorandum, Subject: *Draft Concept for Support Command and Control at Echelons Above Corps,* 1996.

Commander in Chief, U.S. Central Command to Deputy Chief of Staff for Logistics. Letter, Subject: *Draft Concept for Support Command and Control at Echelons Above Corps, May* 15, 1996.

Commander, Third U.S. Army to Deputy Chief of Staff for Logistics. Letter, Subject: *Draft Concept for Support Command and Control at Echelons Above Corps,* April 3, 1996.

Commander, U.S. Army Europe to Commander, U.S. Army Combined Arms Support Command. Memorandum, Subject: *Draft Concept for Support Command and Control at Echelons Above Corps,* May 21, 1996.

Deputy Commandant U.S. Army Engineer School to Stewart, James. Internal Electronic Mail, U.S. Army Engineer Shool. Subject: *Draft Concept for Support Command and Control at Echelons Above Corps,* March 27, 1996.

Software

Microsoft Corporation. *Microsoft Office 4.3*, Redmond WA, 1994.